MEASURING THE IMPACT OF A CLINICAL NURSING INFORMATION SYSTEM ON ONE NURSING UNIT

Deborah K. Hinson, R.N., M.S.; Sue E. Huether, R.N., Ph.D.;
Judith A. Blaufuss, R.N., M.S.; Mig Neiswanger, R.N.; Ann Tinker, R.N., M.S.;
Karen J. Meyer, B.S.; Robert Jensen, Ph.D.
Salt Lake City, UT

The purpose of this project has been to develop a model to evaluate the effectiveness of a computerized nursing information system on one nursing unit. The project has also served as a pilot for the development of the tools used in the study. The model has been developed in one hospital and ultimately will be used in other Intermountain Health Care hospitals where the HELP (Health Evaluation through Logical Processing) nursing information system will be operational. McKay Dee Hospital in Ogden, UT was selected as the data collection site because both the hospital and nursing HELP information systems are being installed at this site. this allowed a greater opportunity to gather descriptive information prior to installation, with repeated measures after the system was installed. The long range goal of the project has been to evaluate the effectiveness of the computerized nursing information system. The project is financially supported by Intermountain Health Care. Installation of the HELP system began at McKay Dee Hospital in 1989. Pre-implementation data collection occurred from July of 1990 through February of 1991. In January and February of 1992 the first post-implementation data collection was conducted followed by a second measurement in January and February of 1993.

Specific objectives of the study are as follows:

1. Identify how nurse user characteristics influence patterns of computer utilization.
2. Identify variables that influence nurses attitudes toward computer utilization.
3. Identify how the unit environment influences the implementation of a Nursing Information System (NIS).
4. Identify how use of a NIS influences the documentation patters of nurses using the NIS.
5. Evaluate maximum gains and cost savings related to implementation and use of the NIS.

DESIGN

The design is descriptive and uses repeated measures to achieve the objectives of the study. The project has three phases. Phase One includes the collection of descriptive information for six months prior to implementation of the NIS. This phase lasted from July of 1990 through February of 1991. The first two months of this period were used for research assistant training and establishment of interrater reliability for the data collected. Data for these two months was not included in the final analysis.

Phase Two included collection of information six months after each module of the NIS was installed. Six months was given before measurement to allow for the learning curve of the nurses following each new module. To date, two measurements have been conducted. The first followed installation of the nurse charting module and occurred in January and February of 1992. The second followed installation of the nurse assessment module and occurred in January and February of 1993.

Sources of information include: direct observation of nurse work patters (work sampling) for an entire 8 or 12 hour shift; nurse demographic data; nurse attitudes, knowledge, satisfaction and motivation to use computers; nursing unit environmental data; and patient hospital records (chart audit). Phase Three is the analysis of the data. We are currently in the middle of Phase Three.

Ten nurses completed the Nurse Attitude Survey and their work activities were observed using

a work sampling form for one 8 or 12 hr. shift once a month (a total of 20 work sampling observations occurred over the two months). Characteristics of the nursing unit environment were documented at each work sampling observation. Three patient records with the observed nurse's documentation were evaluated by chart audit each month (a total of 60 chart audits over two months). The Nurse Attitude Survey was repeated every six months. The data analysis of Phase Three began concurrently with Phase Two and is an ongoing process.

SETTING

The HELP NIS was first installed at LDS Hospital in Salt Lake City, UT and serves as the alpha test site. Currently, the HELP NIS is operational in intensive care units and on adult care units at LDS Hospital. The instruments being used for data collection in this project have evolved as a result of previous research at LDS Hospital during various phases of NIS installation over the past years. (Blaufuss, 1986; Johnson et al, 1987). McKay Dee Hospital, a 420 bed hospital in Ogden, UT is currently a beta test site for the HELP NIS. The HELP NIS is installed on a modular basis. To date, the Nurse Charting (NC) module and the Physical Assessment (PA) modules are installed and measurements have been obtained. the three remaining modules: Functional Health Patterns Admit History, Nursing Care Plan and Medication Charting are forthcoming.

The study is being conducted from data collected on a 29 bed medical unit at McKay Dee Hospital. The unit provides services for acutely ill medical patients including patients recently discharged from the intensive care unit. The unit was selected for the study because 1) nurse staffing on the unit had been stable for two year; 2) the head nurse and staff are willing to participate in the development of the model; and 3) it is a typical nursing unit within the hospital in relation to physical design of the unit, number of beds, census, acuity, admissions, discharges and transfers, patient length of stay, and frequency of special procedures.

SAMPLE

Registered nurses (RN) are the focus of this study. Each month, ten nurses' names were drawn from a collection of all nurses working on the unit. Nurses in the study work both 8 and 12 hour shifts, and work both full and part-time.

INSTRUMENTS

Four tools have been selected and developed for use in the study. An attempt was made at the onset of the study to utilize tools with previously established reliability and validity. Unfortunately, literature review revealed no such instruments. Consequently, it became apparent that tools would have to be developed. Of the four tools used for the study, only the Nurse Attitude Survey has previously established reliability and validity. Content validity and reliability for internal consistency were determined for the developed attitude questionnaire. Nurses' individual characteristics and computer-use satisfaction, beliefs, and motivation were correlated. Data analysis revealed that nurses attitudes were significantly related (satisfaction to beliefs, $r=0.783$, $p<0.001$; satisfaction to motivation, $r=0.598$, $p<0.001$; and beliefs to motivation $r=0.651$, $p<0.001$), supporting the model based on Vroom's expectancy theory. Computer knowledge significantly related to computer-use beliefs ($r=0.229$, $p<0.05$). Length of computer experience ($r=0.265$, $p<0.05$) and nursing experience ($r=-0.239$, $p<0.05$) related negatively to nurses' computer-use satisfaction. The tools used for the study are as follows:

The Nurse Work Sampling Observation Form (WS) documents the type of work (written, verbal, patient care or travel), focus of work (history, assessment, care planning, interventions and charting), location of work (patient room, hall, nurses' station, medication room, work room and other), and recipients of work (patient, patient family, health professional). The items for this tool were defined by a jury of five expert nurses with experience in the development, installation and use of a NIS in acute care settings, and with experience in work sampling.

The Nursing Unit Environmental Data Form (NUEDF) tracks details of the unit environment during work sampling of nurse activities and also during periods when chart audit measurements were obtained. Variables documented with this form include: date, time, census, acuity, staffing, staff mix, work assignments, and patient admission, discharge, transfer, death, or cardiac arrest. The

variables reflect factors that influence the business of the nursing unit.

The Chart Audit Form (CA) provides information about patient problems, problem category (nursing diagnosis, collaborative problems, protocols, short and long term problems), nursing process content (history, assessment, nursing care plan, projected outcomes, interventions, actual outcomes) and completeness of documentation by nurses participating in the study. The form was adapted from a form previously developed for chart audit within a large Intermountain Health Care hospital (Johnson, 1987).

The Nurse Attitude Survey (NAS) is used to compare perceptions of nurses against other variables influencing efficiency of computer use. The components of this survey include: knowledge about use of computers in hospitals; computer skills, beliefs regarding computer use in nursing care; acceptance of computerized data sources; motivations to use the computer for charting; and nurse demographic data (Burkes, 1987).

DATA ANALYSIS

Descriptive and inferential statistics were used to analyze the data and assess relationships among the variables being studied.

1.   Who are the subjects of the study?

Demographic Table

	Computer Experience (Months)	Age (Years)	Nursing Experience (Years)
Minimum	0.0	20.0	0.0
Maximum	120.0	65.0	40.0
± Mean Standard Error	41.56 ± 5.6	31.12 ± 1.56	
Median			3.0

Educational Demographics
1.   Associate Degree   75.6%
2.   Diploma   4.9%
3.   Bachelors Degree Nursing   19.5%

2.   How do nurses spend their time?

	Phase I	Phase II	Phase III
Direct Patient Care (%)	39.02	44.14	49.68
% Of Time Spent In Documentation	27.39	38.98	35.87
% Of Time Spent In Verbal Communication	33.47	16.84	14.15
% Of Time Spent In Data Review	2.72	7.97	10.81
% Of Time Spent On Miscellaneous Forms	7.13	6.72	4.13

3. How does the computer affect patterns of
    nurse charting?

Percent Of Time Spent Documenting In Specific Locations

Location	Phase I	Phase II	Phase III
Hall	0.34%	0.00%	0.12%
Medication Room	6.12%	1.13%	1.85%
Nurses Station	85.7%	57.13%	53.71%
Other	0.2%	0.42%	2.18%
Patient Room	4.39%	25.41%	20.99%
Report Room	3.23%	15.91%	21.16%

4. How complete is nurse documentation on the
    nursing unit studied?

	Phase I	Phase II	Phase III
% Of Problems Charted	94.6	91.9	94.5
% Of Problems Not Charted	5.4	8.1	5.5

$p = 0.14338$

Problems Identified In Nurse Charting

	Phase I	Phase II	Phase III
Problem Was Charted	66.5	79.9	91.8
Problem Was Not Charted	33.5	20.1	8.2

Pearson Chi-Square .00000

Problems Identified In Nurse History

	Phase I	Phase II	Phase III
Problem Was Identified In History	51.1	35.7	32.9
Problem Was Not Identified In History	48.9	64.3	67.1

Pearson Chi-Square .00000

Problems Identified In The Nurse Care Plan

	Phase I	Phase II	Phase III
Problem Was Identified In The NCP	23	18.2	24.7
Problem Was Not Identified In The NCP	77.0	81.8	75.3

Problems Identified In The Nurse Assessment

	Phase I	Phase II	Phase III
Problem Was Identified In Assessment	61.1	67.7	64.4
Problem Was Not Identified In Assessment	38.9	32.3	35.6

Pearson Chi-Square .05772

5. What is the relationship between the completeness of nurse charting and the business of the nursing unit?

Data analysis on this question is on-going and will be presented at the American Medical Informatics Association Symposium.

6. How does the computerized NIS affect the initial documentation of nursing interventions?

	Phase I	Phase II	Phase III
% Of Patient Responses Not Charted	58.4	85.8	77.7

Pearson Chi-Square .00000

7. How does the computerized NIS affect documentation of the evaluation of nursing interventions?

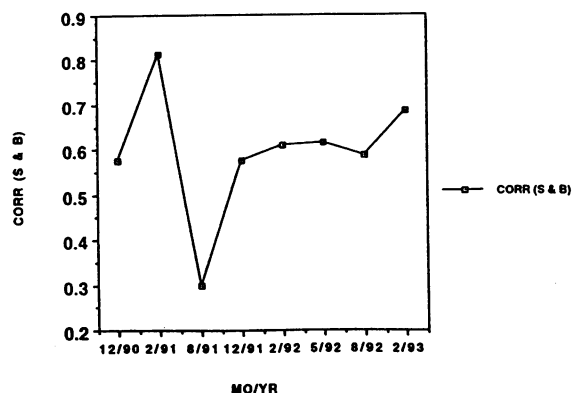|	Phase I	Phase II	Phase III
% Of Patient Responses Not Documented	81.1	94.3	82.9

Pearson Chi-Square .00000

8. How does the computerized nursing information system affect the attitudes of the nurses?
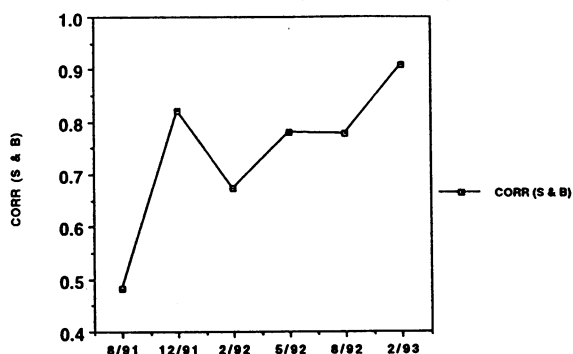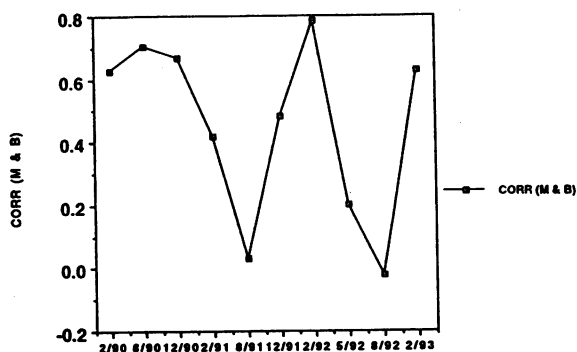
ACCEPTANCE AND BELIEF CORRELATIONS

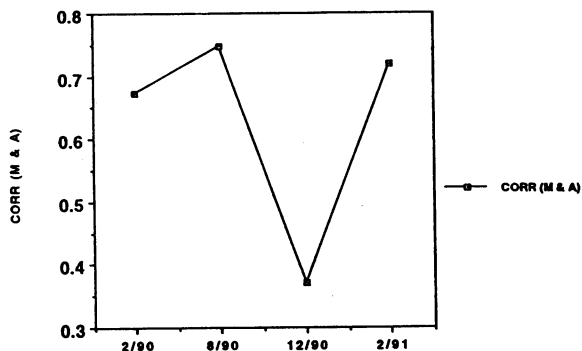## SATISFACTION (LAB REVIEW-ORDER ENTRY) AND BELIEF CORRELATIONS
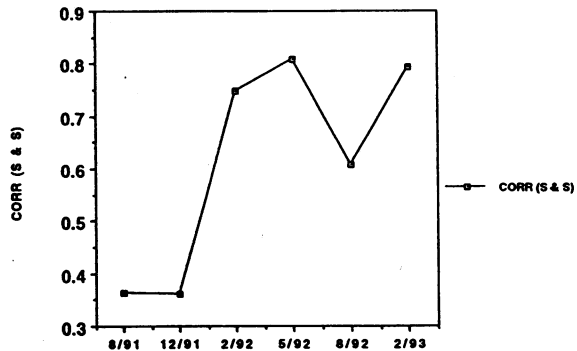

SATISFACTION (CHARTING) AND BELIEF CORRELATIONS

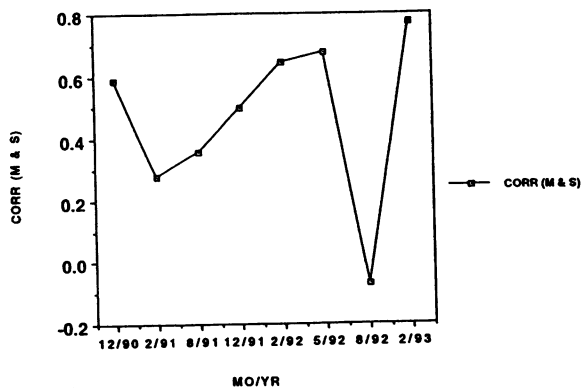## MOTIVATION AND BELIEF CORRELATIONS
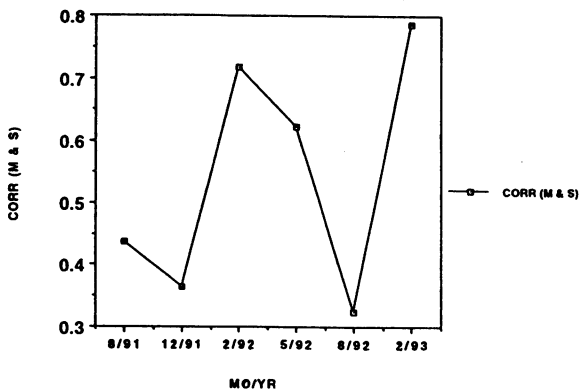

MOTIVATION AND ACCEPTANCE CORRELATIONS

SATISFACTION (LAB REVIEW-ORDER ENTRY) AND SATISFACTION (CHART) CORRELATIONS

MOTIVATION AND SATISFACTION (LAB REVIEW-ORDER ENTRY) CORRELATIONS

MOTIVATION AND SATISFACTION (CHART) CORRELATIONS

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